

# Approach to Chest Pain

# Cardinal Manifestations

- Chest Pain
- Dyspnea
- Palpitations
- Fatigue
- Syncope

- Which of the grading system in cardiology is not used for assessment of chest pain?

1. NYHA

2. CCS

3. Goldman SAS

4. MMRC

# Grading system for chest pain

- NYHA
- Goldman specific activity scale
- Canadian cardiovascular Society Score

# Chest pain

- 10-15 % of acute chest pain have ACS

- What is typical angina?

1. Site
2. Aggravating factors
3. Relieving factors

## Anginal Equivalent

### Non Cardiac

Sharp pain

Positional

On Palpation

Pleuritic

Constant pain

Brief episodes

Unusual radiation

Easily localised

- Less typical /No angina

1. Women

2. Elderly

3. Diabetes

4. After Cardiac transplant

5. Under GA

High likelihood of ACS  
Prior abnormal stress test

H/o CAD

H/o PAD

# Common Causes of Chest Pain

Cardiac	Angina	Retrosternal chest pressure, burning, or heaviness; radiating occasionally to the neck, jaw, epigastrium, shoulders, left arm	Precipitated by exercise, cold weather, or emotional stress; duration of 2–10 min
	Rest or unstable angina	Same as angina, but may be more severe	Typically <20 min; lower tolerance for exertion; crescendo pattern
	Acute myocardial infarction	Same as angina, but may be more severe	Sudden onset, usually lasting ≥30 min; often associated with shortness of breath, weakness, nausea, vomiting
	Pericarditis	Sharp, pleuritic pain aggravated by changes in position; highly variable duration	Pericardial friction rub
Vascular	Aortic dissection	Excruciating, ripping pain of sudden onset in the anterior aspect of the chest, often radiating to the back	Marked severity of unremitting pain; usually occurs in the setting of hypertension or underlying connective tissue disorder such as Marfan syndrome
	Pulmonary embolism	Sudden onset of dyspnea and pain, usually pleuritic with pulmonary infarction	Dyspnea, tachypnea, tachycardia, signs of right-sided heart failure
	Pulmonary hypertension	Substernal chest pressure, exacerbated by exertion	Pain associated with dyspnea and signs of pulmonary hypertension

Pulmonary	Pleuritis and/or pneumonia	Pleuritic pain, usually brief, over the involved area	Pain pleuritic and lateral to the midline, associated with dyspnea
	Tracheobronchitis	Burning discomfort in the midline	Midline location, associated with coughing
	Spontaneous pneumothorax	Sudden onset of unilateral pleuritic pain, with dyspnea	Abrupt onset of dyspnea and pain
Gastrointestinal	Esophageal reflux	Burning substernal and epigastric discomfort, 10–60 min in duration	Aggravated by a large meal and postprandial recumbency; relieved by antacid
	Peptic ulcer	Prolonged epigastric or substernal burning	Relieved by antacid or food
	Gallbladder disease	Prolonged epigastric or right upper quadrant pain	Unprovoked or following a meal
	Pancreatitis	Prolonged, intense epigastric and substernal pain	Risk factors, including alcohol, hypertriglyceridemia, medications



Musculoskeletal	Costochondritis	Sudden onset of intense fleeting pain	May be reproduced by pressure over the affected joint; occasionally, swelling and inflammation over the costochondral joint
	Cervical disc disease	Sudden onset of fleeting pain	May be reproduced with movement of the neck
	Trauma or strain	Constant pain	Reproduced by palpation or movement of the chest wall or arms
Infectious	Herpes zoster	Prolonged burning pain in a dermatomal distribution	Vesicular rash, dermatomal distribution
Psychological	Panic disorder	Chest tightness or aching, often accompanied by dyspnea and lasting 30 min or more, unrelated to exertion or movement	Patient may have other evidence of an emotional disorder

# Red Flag Signs in ER

- Chest pain that radiates
- Indigestion or heart burn; nausea or vomiting associated with chest pain
- Persistent shortness of breath
- Weakness , dizziness, lightheadedness or LOC

Which of the following has the highest likelihood ratio for ACS in a patient presenting with chest pain?

- A. Pain radiating to left arm
- B. Pain radiating to right arm
- C. Pain radiating to both shoulders
- D. Non radiating chest pain

PAIN DESCRIPTOR	POSITIVE LIKELIHOOD RATIO (95% CI)
<b>Increased Likelihood of AMI</b>	
Radiation to the right arm or shoulder	4.7 (1.9-12.0)
Radiation to both arms or shoulders	4.1 (2.5-6.5)
Associated with exertion	2.4 (1.5-3.8)
Radiation to the left arm	2.3 (1.7-3.1)
Associated with diaphoresis	2.0 (1.9-2.2)
Associated with nausea or vomiting	1.9 (1.7-2.3)
Worse than previous angina or similar to previous MI	1.8 (1.6-2.0)
Described as pressure	1.3 (1.2-1.5)
<b>Decreased Likelihood of AMI</b>	
Described as pleuritic	0.2 (0.1-0.3)
Described as positional	0.3 (0.2-0.5)
Described as sharp	0.3 (0.2-0.5)
Reproducible with palpation	0.3 (0.2-0.4)
Inframammary location	0.8 (0.7-0.9)
Not associated with exertion	0.8 (0.6-0.9)

**CAD:** Blood pressure , e/o CCF MR hypotension , e/o PAD

Blood pressure or pulse discrepancies , new onset AR murmur ,

Presence of friction rub

Tachycardia , tachypnea and Loud P2

ECG FINDING	POSITIVE LIKELIHOOD RATIO (95% CI WHERE AVAILABLE)
New ST-segment elevation $\geq 1$ mm	5.7-53.9
New Q wave	5.3-24.8
Any ST-segment elevation	11.2 (7.1-17.8)
New conduction defect	6.3 (2.5-15.7)
New ST-segment depression	3.0-5.2
Any Q wave	3.9 (2.7-5.7)
Any ST-segment depression	3.2 (2.5-4.1)
T wave peaking and/or inversion $\geq 1$ mm	3.1
New T wave inversion	2.4-2.8
Any conduction defect	2.7 (1.4-5.4)

## Normal ECG

1. Does not exclude possibility of CS
2. 4 % with h/o CAD and 2 % with no Hx can still have ACS
3. Better prognosis than those with abnormal ECG at initial Dx
4. NPV of 80-90 % irrespective of angina

## Rule out

1. Pulmonary embolism
2. Pericarditis

## Importance of taking posterior leads on ECG

# Relevance of CXR in Chest pain?

- Usually normal
- Widened Mediastinum/calcium sign
- Signs of pulmonary edema in CAD
- PE usually normal but see other signs
- Pneumonia / Pneumothorax

# Biomarkers

- Troponin Hs
- CKMB ----Lack of specificity
- MBPC , Copeptin , CRP , SAA , MPO, IL-6
- D-dimer -----high NPV for PE and Ao dissection
- Role of BNP

## Myocardial injury related to acute myocardial ischemia

Atherosclerotic plaque disruption with thrombosis

## Myocardial injury related to acute myocardial ischemia because of oxygen supply/demand imbalance

### *Reduced myocardial perfusion*

- Coronary artery spasm, microvascular dysfunction
- Coronary embolism
- Coronary artery dissection
- Sustained bradycardia
- Hypotension or shock
- Respiratory failure
- Severe anemia

### *Increased myocardial oxygen demand*

- Sustained tachycardia
- Severe hypertension with or without left ventricular hypertrophy

## Other causes of myocardial injury

### *Cardiac conditions*

- Heart failure
- Myocarditis
- Cardiomyopathy (any type)
- Takotsubo syndrome
- Coronary revascularization procedure
- Cardiac procedure other than revascularization
- Catheter ablation
- Defibrillator shocks
- Cardiac contusion

### *Systemic conditions*

- Sepsis, infectious disease
- Chronic kidney disease
- Stroke, subarachnoid hemorrhage
- Pulmonary embolism, pulmonary hypertension
- Infiltrative diseases, e.g., amyloidosis, sarcoidosis
- Chemotherapeutic agents
- Critically ill patients
- Strenuous exercise



## Not a Myocardial Infarction

Direct  
Myocardial  
Damage

### Cardiac

Congestive heart failure  
Infection

- Viral cardiomyopathy

Inflammation

- Myocarditis
- Pericarditis

Trauma

- Surgery
- Electrical shock

Ablation procedures  
Malignancy  
Stress cardiomyopathy  
Infiltrative diseases

### Systemic

Pulmonary embolism  
Toxicity

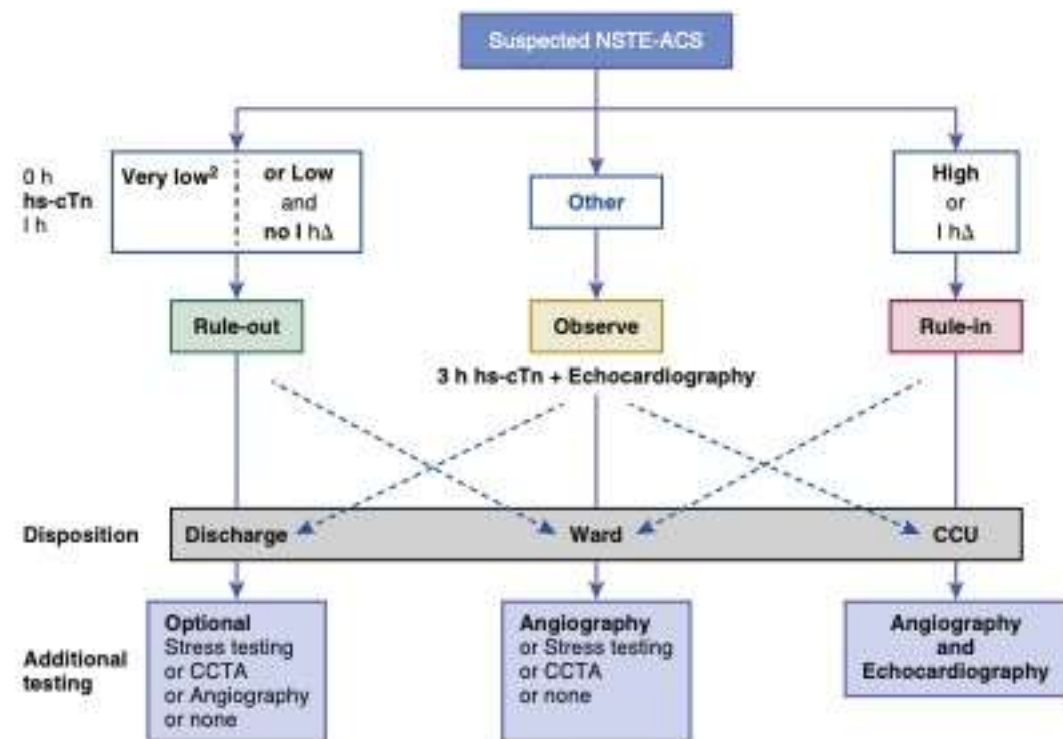
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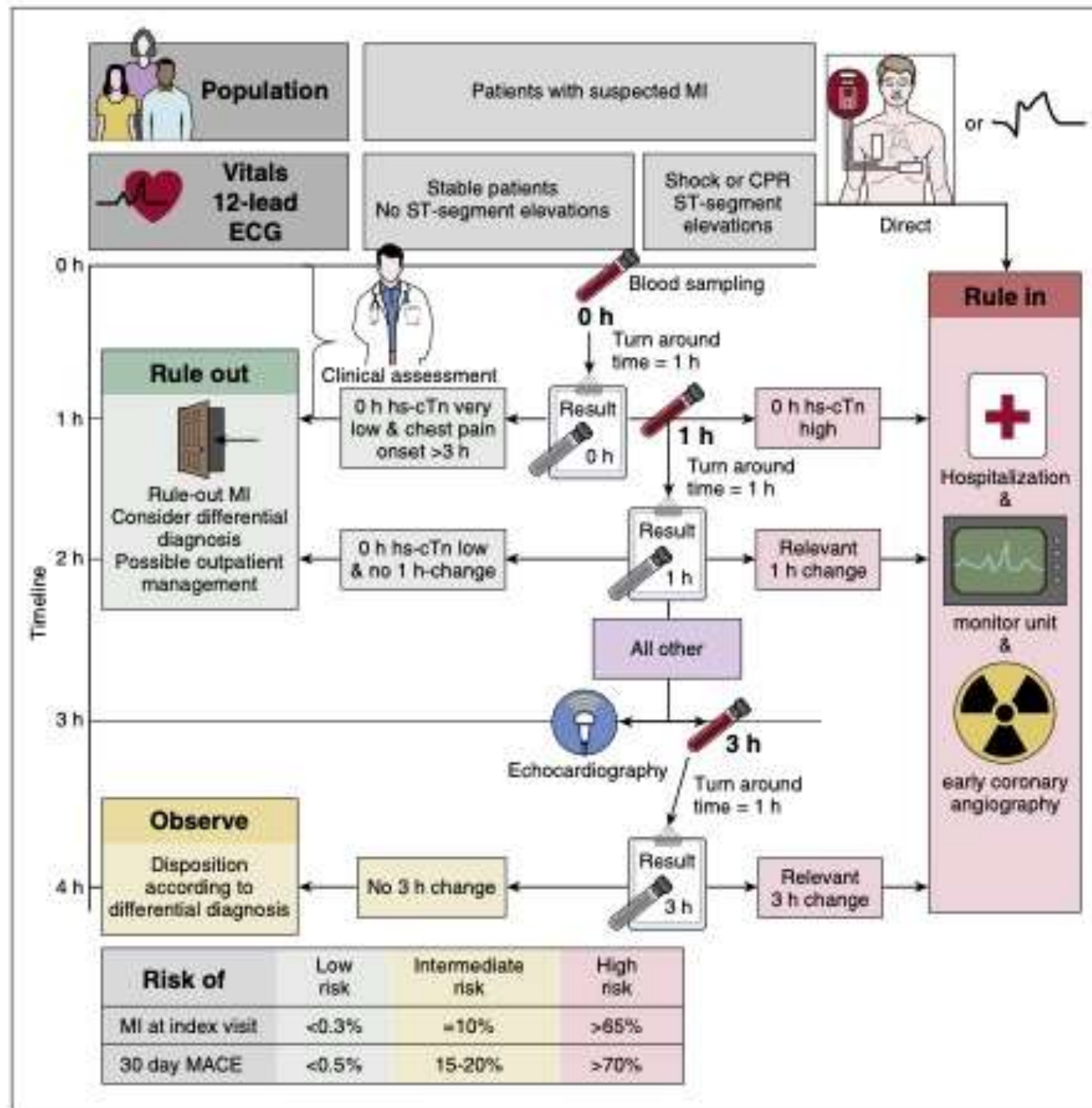
Trauma

- Blunt chest wall injury
- Congestive heart failure (due to volume overload)

Renal failure  
Sepsis  
Stroke  
Subarachnoid hemorrhage

	LOW	MI		HIGH		
I. Clinical setting symptoms and vital signs						
II. ECG	 Normal ECG	 ST depression (mild)	 ST depression	 ST elevation		
III. Troponin level at 0 h	-	-/+	+	++	+++	
IV. Troponin change (within 1, 2, or 3 h)	-	-/+	+	++	+++ if any of the above consider direct rule	
Triage decision	Rule-out MI		Observe	Rule-in MI		
Diagnosis	Noncardiac		Unstable angina	Other cardiac	NSTEMI	STEMI





## TIMI RISK SCORE

FEATURE	ADD +1 FOR EACH COMPONENT
Age $\geq 65$	Yes
Coronary risk factors (hypertension, hypercholesterolemia, diabetes, family history of coronary disease, current smoking)	$\geq 3$
Known coronary artery disease (stenosis $\geq 50\%$ )	Yes
Aspirin use in the past 7 days	Yes
Severe angina ( $\geq 2$ episodes in 24 hr)	Yes
ECG ST deviation $\geq 0.5$ mm	Yes
Positive cardiac biomarker	Yes

## HEART SCORE

FEATURE	ADD +2 FOR EACH COMPONENT	ADD +1 FOR EACH COMPONENT	ADD 0 FOR EACH COMPONENT
History	Highly suspicious	Moderately suspicious	Slightly suspicious
Electrocardiogram	Significant ST-segment deviation not due to left bundle branch block, left ventricular hypertrophy or digoxin	No ST-segment deviation but nonspecific repolarization disturbance	Normal
Age	$\geq 65$	45-64	$< 45$
Risk factors (hypertension, hypercholesterolemia, diabetes mellitus, body mass index $> 30$ kg/m <sup>2</sup> , smoking, early family history, known atherosclerotic disease)	$\geq 3$	1-2	0
Initial troponin	$> 3 \times$ normal limit	1-3x normal limit	$\leq$ normal limit

Which of the following is not a component of low-risk criteria in a patient presenting with chest pain in ER?

- A. Normal ECG
- B. Non rising hs troponin levels
- C. TIMI risk score less than 2
- D. HEART score less than 3



# LOW RISK PTS

- No ECG abnormalities
- Normal troponin levels
- TIMI risk score 0
- HEART score  $\leq 3$

## Requirements before exercise electrocardiographic testing that should be considered in the ED setting:

- No evidence of myocardial injury by serial troponin (see section on biomarkers)
- ECG at the time of arrival and preexercise 12-lead ECG show no significant abnormality
- Absence of rest electrocardiographic abnormalities that would preclude accurate assessment of the exercise ECG
- From admission to the time that results are available from the second set of cardiac enzymes: patient asymptomatic, lessening chest pain symptoms, or persistent atypical symptoms
- Absence of ischemic chest pain at the time of exercise testing

# Which test to choose?

- Stress ECG(TMT)
- Myocardial perfusion Imaging
- Stress echocardiography(same sensitivity and high specificity)
- CMRI
- Anatomic Imaging with CCTA

Which of the following is not a component of vulnerable plaque in CCTA

- A. Stenosis more than 50 %
- B. More than 30 HU plaque
- C. Spotty calcium
- D. Napkin ring appearance



# CCTA in acute chest pain

- Advanced features of CAD: > 50 % stenosis and high-risk plaque features such as positive remodeling , low less than 30 HU plaque , napkin ring appearance and spotty calcium)
- Reasonable alternative to stress testing in low-intermediate probability Cad
- Triple rule out scan

# History Taking

- Risk factors
- Triggering factors
- Onset and evolution
- Localization of pain
- Pain quality
- Associated symptoms
- Relieving factors
- Frequency of symptoms

# Named Angina Syndrome

- Warm up Angina
- Walk through Angina
- Linked Angina
- Post Prandial Angina
- Nocturnal Angina
- Micro vascular Angina(Syndrome X)